QUALITY ASSURANCE ADDENDUM

QAA 2.1

to the

ROCKY FLATS PLANT SITE-WIDE QA PROJECT PLAN

FOR CERCLA RI/FS AND RCRA RFI/CMS ACTIVITIES

for

OPERABLE UNIT NO. 2 (ALLUVIAL), 903 PAD, MOUND, AND EAST TRENCHES AREAS

PHASE II RFI/RI

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PHASE II RFI/RI

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

TITLE:
Quality Assurance Addendum for Operable Unit No. 2
(Alluvial) Phase II RFI/RI, 903 Pad,

Approved by:

(FOR T. C. GREENWOOD)
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Manager, Remediation Programs Division

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INTRODUCTION AND SCOPE

This Quality Assurance Addendum (QAA) supplements the "Rocky Flats Plant Site-Wide Quality Assurance Project Plan for CERCLA RI/FS and RCRA RFI/CMS Activities" (QAPjP) for alluvial field investigation activities described in the Phase II RFI/RI Alluvial Workplan for 903 Pad, Mound, and East Trenches Areas (Operable Unit [OU] No. 2) dated January 1991 (OU-2 Alluvial Workplan).

1.0 ORGANIZATION AND RESPONSIBILITIES

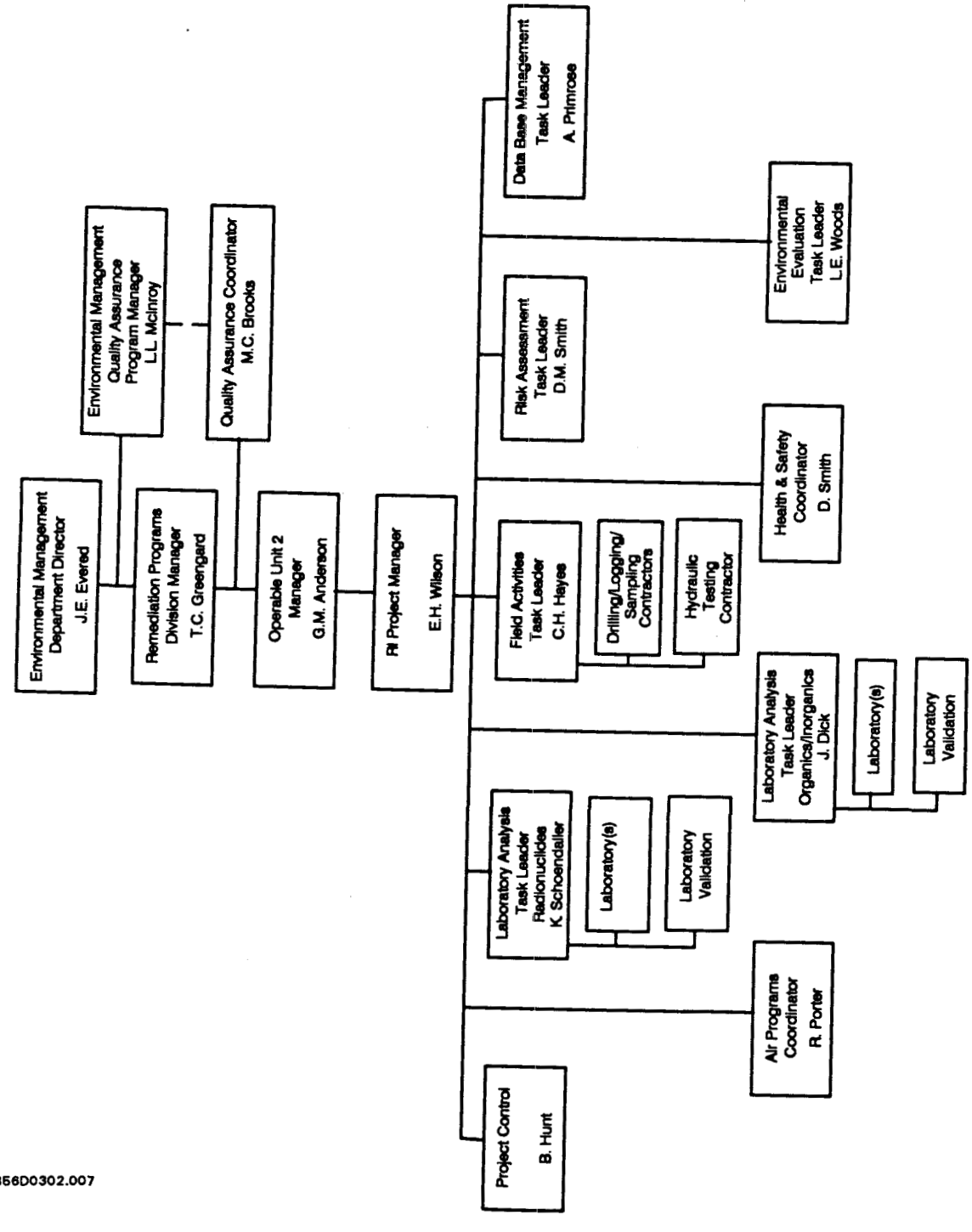
The overall organization of EG&G Rocky Flats and the Environmental Management (EM) Department divisions involved in Environmental Restoration (ER) Program activities is shown in Section 1 of the QAPjP. Specific responsibilities are also described in detail in Section 1 of the QAPjP.

Contractors will be tasked by EG&G Rocky Flats to implement the Phase II Alluvial Workplan (OU-2 Alluvial Workplan). The specific EM Department personnel who will interface with the Contractors and who will be authorized to provide technical direction are shown in Figure 1.

2.0 QUALITY ASSURANCE PROGRAM

The QAPjP was written to specifically address QA controls for Interagency Agreement (IAG) related activities. The content of the QAPjP was driven by DOE RFP SOP 5700.6B, which requires that a QA program be implemented for all Rocky Flats Plant (RFP) activities based on ASME NQA-1, "Quality Assurance Requirements for Nuclear Facilities," as well as the IAG, which specifies that a QAPjP for IAG-related activities be developed in accordance with EPA QAMS-005/80, "Interim Guidelines and Specifications for Preparing QAPjPs." The 18-element format of NQA-1 was selected as the basis for both the plan and subsequent QAAs with the applicable elements of EPA QAMS-005/80 incorporated where appropriate.

FIGURE 1. PROJECT MANAGEMENT FOR OPERABLE UNIT 2 (Alluvial), 903 PAD, MOUND, EAST TRENCHES, PHASE II RFI/RI



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The QA controls and requirements addressed in the QAPjP are applicable to OU-2 Alluvial Workplan activities, unless otherwise specified in this QAA. As a supplement to the QAPjP, this QAA addresses additional and site-specific QA controls and requirements that are applicable to OU-2 Alluvial Phase II activities.

2.1 Training

All personnel (including contractor personnel) shall complete the orientation and personnel training specified in Section 2 of the QAPjP. Additional training is required for all personnel performing activities in accordance with the Environmental Monitoring Assessment Division (EMAD) Operating Procedures (OPs), which are also referred to herein as Standard Operating Procedures (SOPs), specified in Table 1 of this QAA. Those personnel shall receive documented training in this QAA and the applicable SOPs prior to performing the work.

3.0 DESIGN CONTROL AND CONTROL OF SCIENTIFIC INVESTIGATIONS

The OU-2 Alluvial Workplan is the design control plan for the Phase II RFI/RI OU-2 alluvial investigations. The sampling rationale and investigation program, including sample locations, frequency, and analytical requirements, are discussed in the Field Sampling Plan (Section 5) of the OU-2 Bedrock Workplan and are summarized in this QAA. The data quality objectives (DQOs) for the Phase II alluvial investigations are identified in this QAA, as are the specific SOPs that will be implemented by EG&G Rocky Flats and contractor personnel during all aspects of the field investigation.

3.1 Data Quality Objectives

3.1.1 Objectives

The Field Sampling Plan of the OU-2 Alluvial Workplan (Section 5) is designed to obtain data necessary to further characterize the physical and hydrological features of the 903 Pad, Mound, and East Trenches area, with a particular emphasis on groundwater flow and interaction of surface

TABLE 1
Standard Operating Procedures and Field Activities for Which They are Applicable

New EMAD OPS Reference Number	Former SOP Reference Number	Standard Operating Procedures	Field Screening	Surveys	Well Drilling, Completion, Development	Ground-Water Sampling	Surface-Water Sampling	Sediment Sampling	Surface Soil Sampling	Subsurface Soil/Rock Sampling	Source Sampling	Biota Sampling	Sample Containerization, Preservation, Handling, and Shipping
GN.17	1.1	Wind Blown Contaminant Dispersion Control		●	●					●			
GN.12	1.2	Field Document Control	●		●	●	●	●	●	●	●	●	
GN.09	1.3	General Equipment Decontamination	●		●	●	●	●	●	●	●	●	
GN.10	1.4	Heavy Equipment Decontamination		●	●	●	●	●	●	●	●	●	
GN.04	1.5	Handling of Purge and Development Water			●	●							
GN.05	1.6	Handling of Personal Protective Equipment	●		●	●	●	●	●	●	●	●	
GN.11	1.7	Handling of Decontamination Water & Wash Water	●		●	●	●	●	●	●	●	●	
GN.06	1.8	Handling of Drilling Fluids & Cuttings			●			●		●			
GN.07	1.9	Handling of Residual Samples							●	●	●	●	
GN.01	1.10	Receiving, Labeling, and Handling Waste Containers			●	●				●	●	●	
GN.14	1.11	Field Communications	●		●	●	●	●	●	●	●	●	
GN.18	1.12	Decontamination Facility Operations	●		●	●	●	●	●	●	●	●	
GN.02	1.13	Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples				●	●	●	●	●	●	●	
GN.15	1.14	Data base Management	●		●	●	●	●	●	●	●	●	
GN.03	1.15	Use of PIDs and FIDs			X	X	X	X	X	X	X	X	
GN.08	1.16	Field Radiological Measurements											
		a) Walk-Over Surveys	●		X	X	X	X	X	X	X	X	
		b) Sample and Waste Screening			X	X	X	X	X	X	X	X	
GW.01	2.1	Water Level Measurements in Wells and Piezometers			●	●							
GW.02	2.2	Well Development											
		a) New Wells			●								
		b) Redevelopment			●								
GW.03	2.3	Pump-in Borehole Packer Tests			●	●							
GW.06	2.5	Measurements for Groundwater Field Parameters				●							
GW.04	2.6	Groundwater Sampling											
		a) Bailer				●							
		b) Pump				●							

X - As required by H&S plan.

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TABLE 1 (Continued)
Standard Operating Procedures and Field Activities for Which They are Applicable

New EMAD OPS Reference Number	Former SOP Reference Number	Standard Operating Procedures	Field Screening	Surveys	Well Drilling	Completion	Ground-Water Development	Sampling	Surface-Water Sampling	Sediment Sampling	Surface Soil Sampling	Subsurface Soil Sampling	Source Sampling	Biota Samples
GT.09	3.1	Logging Alluvial and Bedrock Material			●							●		
GT.01	3.2	Drilling and Sampling Using Hollow-Stem Auger Techniques a) Drilling			●							●		
		b) Continous Auger Coring			●							●		
GT.02	3.3	Isolating Bedrock from Alluvium with Grouted Surface Casing			●									
GT.04	3.5	Plugging and Abandonment of Boreholes			●							●		
GT.05	3.6	Monitoring Well and Piezometer Installation			●									
GT.06	3.7	Logging of Test Pits and Trenches										●		
GT.07	3.8	Surface Soil Sampling									●			
GT.11	3.9	Soil Gas Sampling and Field Analysis	●											
GT.10	3.10	Borehole Clearing										●		
GT.12	3.11	Plugging and Abandonment of Wells			●									
SW.01	4.1	Surface Water Data Collection Activities							●					
SW.02	4.2	Field Measurement of Surface Water Parameters							●					
SW.03	4.3	Surface Water Sampling							●					
SW.06	4.6	Sediment Sampling								●				
EE.01	5.1	Sampling of Periphyton											●	●
EE.02	5.2	Sampling of Benthic Macroinvertebrates											●	●
EE.04	5.4	Sampling of Fishes											●	●
EE.06	5.6	Sampling of Small Mammals											●	●
EE.09	5.9	Sampling of Terrestrial Arthropods											●	●
EE.10	5.10	Sampling of Terrestrial Vegetation											●	●

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and groundwater pathways. The data obtained will also provide for further characterization of contaminant sources, characterization of the nature and extent of contamination at the Individual Hazardous Substance Sites (IHSSs), and support the Baseline Risk Assessment and Environmental Evaluation. The Field Sampling Plan presents a four-step approach to realizing these overall goals. The four steps include:

(1) reviewing existing data,
(2) conducting preliminary screening study activities,
(3) conducting detailed field sampling programs, and
(4) conducting field and analytical laboratory testing programs.

The detailed field sampling activities of the third step include:

- Plume characterization, requiring monitoring, well installation, and groundwater sampling.
- Source characterization, requiring drilling boreholes for subsurface sampling, well installation, and groundwater sampling.
- Surficial soil and groundwater and sediment sampling.
- Environmental evaluation studies.

In addition to the Field Sampling Plan activities described in Section 5 of the OU-2 Alluvial Workplan, environmental evaluation (EE) field sampling activities will also be conducted as described in the OU-2 Environmental Evaluation Workplan (Section 6 of the OU-2 Alluvial Workplan). The overall objectives of the EE field sampling activities are to (1) characterize the biological resources in order to conduct the ecological impact assessment, and (2) acquire the data needed to measure the effects of contaminants on ecological systems. In order to accomplish these overall objectives, field investigations, sampling, and analysis will be conducted that consist of the following:

- Qualitative aquatic and terrestrial ecosystem field surveys,

- Comparative ecology studies, based on quantitative terrestrial and aquatic field sampling and analysis,
- Toxicity testing of aquatic organisms and, potentially, terrestrial organisms, and
- Bioaccumulation studies.

Table 3-1 of the OU-2 Alluvial Workplan lists the specific objectives for each of the Phase II RFI/RI activities. The analytical levels that are appropriate to provide data to meet the objectives listed in Table 3-1 of the OU-2 Alluvial Workplan include Levels I - V. These analytical levels are discussed and described in Appendix A of the QAPjP. Table A1.3 of the QAPjP (Appendix A) lists the data quality controls and types of analytical methods that are appropriate for the various analytical levels. Based on these data quality controls and recommended analytical methods, the following DQOs for the OU-2 Alluvial Workplan investigations are established.

Data quality controls for analytical level I activities (e.g., drilling, monitoring well installation, hydraulic property testing, and water level monitoring) consist of adhering to specific field instrument calibration instructions and field monitoring/testing SOPs. Precision, accuracy, and completeness parameters are not applicable for analytical level I activities. The precision, accuracy, and completeness parameters for levels II - V are discussed below, along with comparability and representativeness for all levels.

3.1.2 Precision and Accuracy

The DQOs for precision and accuracy for the analytical methods referenced in the Rocky Flats General Radiochemistry and Routine Analytical Services Protocol (GRRASP), which includes EPA CLP protocols and standard EPA methods when CLP protocols are unavailable, are included in Appendix B of the QAPjP. The analytical program for the OU-2 alluvial investigations will utilize the analytical methods referenced in the GRRASP. Therefore, objectives for precision and accuracy referenced in the QAPjP are applicable to the OU-2 Alluvial Phase II RFI/RI. The analytical methods, detection limits, and DQOs for precision and accuracy for the groundwater, surface water, and soil and sediment sampling parameters listed in Table 5-3 of the OU-2 Alluvial Workplan are presented here in Appendix A.

3.1.3 Completeness

The target completeness objective for both field and analytical data for this project is 90 percent.

3.1.4 Comparability

Comparability is a qualitative parameter that is ensured by implementation of the sampling and analysis plan, standardized analytical protocols, SOPs for field investigations, and by reporting data in uniform units as specified in the SOPs applicable to the OU-2 Alluvial Workplan.

3.1.5 Representativeness

Representativeness is a qualitative parameter that is ensured through the careful development and review of the sampling and analysis strategy outlined in the OU-2 Alluvial Workplan and SOPs for sample collection and analysis and field data collection.

3.1.6 DQOs for Environmental Evaluation Investigations

DQOs for the environmental evaluation (EE) investigations described in the Environmental Evaluation Workplan for OU-2 will be developed following a review of existing information from prior studies (e.g., Phase I RFI/RI for OU-2, RFP EIS Database, etc.) and after completing initial field investigations to characterize the RFP ecosystems. This review and initial field investigations, consisting primarily of qualitative field surveys, will allow investigators to obtain information regarding the presence of site-specific receptor species and potential exposure pathways that are necessary to develop the DQOs. The DQO development process will then include identification of data uses and needs and a refinement of the proposed data collection program as described in the OU-2 EE Workplan. The development of DQOs for the EE will follow the steps recommended by EPA in EPA/600/3-89/013, Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference Document, and EPA/540/G-90/008, Guidance for Data Usability in Risk Assessment.

3.2 Sampling Locations and Sampling Procedures

The design and rationale of the field investigations are described in the Field Sampling Plan presented in the OU-2 Alluvial Workplan (Section 5.0). The field screening activities that will be conducted in advance of implementing the detailed field sampling plan will be conducted according to approved SOPs. The walk-over radiological surveys to be conducted at the location of each borehole will be done according to SOP 1.16, Field Radiological Measurements. The soil gas monitoring surveys will be conducted according to SOP 1.15, Use of PIDs and FIDs. The handling of drilling wastes will be done according to SOP 1.8, Handling of Drilling Fluids and Cuttings.

The location of all proposed boreholes and monitoring wells for the plume characterization program are listed in Table 5-1 and shown on Plate 1 of the OU-2 Alluvial Workplan. Table 5-2 of the OU-2 Alluvial Workplan lists the proposed boreholes and monitoring wells for the source characterization program. The purpose and anticipated depth of each borehole and well are presented in those tables. The locations and intent of these boreholes and monitoring wells is further discussed in Sections 5.2 and 5.3 of the OU-2 Alluvial Workplan.

The SOPs that are applicable to the OU-2 Alluvial Phase II RFI/RI field sampling program are listed in Table 1. Drilling and sampling of boreholes and wells will be done according to SOP 3.2, Drilling and Sampling Using Hollow-Stem Auger Techniques. The lithology of all boreholes will be logged in accordance with SOP 3.1, Logging Alluvial and Bedrock Materials. The bedrock will be isolated from the alluvium in all boreholes that encounter bedrock, according to SOP 3.3, Isolating Bedrock from Alluvium with Grouted Surface Casing. During drilling, soil and weathered and unweathered bedrock will be screened for volatile organic compounds by the headspace methods described in SOP 3.9, Soil Gas Sampling and Field Analysis.

As part of the source characterization program, in-situ packer tests will be performed according to SOP 2.3, Pump-In Borehole Packer Testing, in boreholes that penetrate weathered bedrock immediately beneath the IHSS. Boreholes that are not completed as wells for groundwater monitoring will be plugged according to SOP 3.5, Plugging and Abandonment of Boreholes. Those

boreholes that are completed for groundwater monitoring will be developed according to SOPs 2.2, Well Development, and 3.6, Monitoring Well and Piezometer Installation.

Groundwater measurements and sampling will be conducted according to SOPs 2.1, Water Level Measurements in Wells and Piezometers; 2.5, Measurement for Groundwater Field Parameters; and 2.6, Groundwater Sampling. At least one groundwater sample will be collected from each well for laboratory analysis of parameters listed in Table 5-3 of the OU-2 Alluvial Workplan. Water level measurements will be taken monthly throughout the field investigation. During groundwater sampling, a check for the presence of non-aqueous phase liquids in the well will be made per SOP 2.1. If detected, non-aqueous phase liquids will be sampled according to SOP 2.6.

Section 5.4 and Attachment 1 of the OU-2 Alluvial Workplan describe a detailed soil sampling program consisting of spatial distribution sampling and vertical distribution sampling. The specific objectives of the proposed surficial soil investigation are: to determine the spatial and vertical extent of plutonium and americium in soils of the remedial investigation areas, and in the buffer zone; to study the physicochemical association of plutonium and americium in surficial soils (static and mobile soil phases) above seeps SW-50, SW-53, and SW-54; to study the movement of both water and radionuclides (colloidal and dissolved) down the soil column; and to ascertain the hydrogeochemical relationships between the soil interstitial water and the seeps downslope. The samples collected during the spatial distribution will be collected according to the Colorado Department of Health soil sampling protocol, which is described in SOP 3.8, Surface Soil Sampling. The vertical distribution sampling will be conducted according to the method described in the Workplan. The soil morphology of the soil trenches will be described according to SOP 3.1, Logging Alluvial and Bedrock Material.

Subsurface soil samples will be collected from boreholes within and adjacent to the IHSSs according to SOP 3.2, Drilling and Sampling Using Hollow-Stem Auger Techniques. Bulk subsurface samples will be collected from continuous cores of alluvial wells (also according to SOP 3.2). These bulk samples will be partitioned according to each geologic material type, and 10 samples of each type will be submitted for physical analysis. Subsurface material types will be determined following SOP 3.1.

Surface water and sediment samples are being collected from seeps and bodies of water within the South Walnut and Woman Creek drainages. The sampling stations that will contribute data to the OU-2 Alluvial investigations are shown in Table 5-4 of the OU-2 Alluvial Workplan. This surface water and sediment sampling is being conducted according to SOPs 4.1, Surface Water Data Collection Activities; 4.2, Field Measurements of Surface Water Field Parameters; 4.3, Surface Water Sampling; and 4.6, Sediment Sampling.

3.3 Analytical Procedures

The analytical program for OU-2 Alluvial activities is discussed in Section 5.5 of the OU-2 Alluvial Workplan. The analytical methods for the analytes listed in Table 5-3 of the OU-2 Workplan that shall be adhered to are those that are specified in the GRRASP. Those methods are referenced in Section 3.3.3 of the QAPjP. Specific analytical methods for each analyte are also referenced here in Appendix A. In addition to the analytical methods listed in Appendix A, soil samples from the vertical distribution sampling profiles will be subjected to sesquioxide, carbonate, organic carbon, and residue extractions, as described in Attachment 1 of the OU-2 Alluvial Workplan.

3.4 Physical Analysis

Physical analysis on subsurface soil samples will consist of classification (ASTM D2488), moisture content (ASTM D2216), and dry density for intact samples (ASTM D2216). Laboratory classification tests will consist of grain size distribution (ASTM D422) and Atterberg limits (ASTM D4318). Laboratory classifications will be conducted for a minimum of 10 samples of each general alluvial material type.

3.5 Environmental Evaluation

3.5.1 Summary of Surveying and Sampling

The principal components of the EE for OU-2, as described in Section 6 of the OU-2 Alluvial Workplan, consist of an environmental analysis, toxicity assessment, and risk characterization. Six

tasks will be conducted as part of the OU-2 EE. These tasks include: (1) reviewing existing information, (2) existing data evaluation and analysis, (3) field investigations, (4) ecological risk assessment, (5) preparation of an Environmental Evaluation Report, and (6) project management and documentation. The quality controls for obtaining environmental data through conducting field investigations are addressed here.

The EE Field Sampling Plan (FSP) is described in detail in Section 6.2.2.4 and Attachment 2 of the OU-2 Alluvial Workplan. The FSP has two overall objectives: (1) to characterize biological resources, and (2) to acquire the data necessary to measure ecological effects of contaminants. The field sampling program consists of a phased, two-component approach. First, qualitative surveys will be conducted, which will then be followed by quantitative field sampling. The qualitative field surveys will provide information that will help finalize the quantitative sampling plan and develop the EE DQOs.

Quantitative field samples will be collected for the following environmental parameters:

- Periphyton
- Benthic macroinvertebrates
- Fish
- Terrestrial vegetation (including wetlands)
- Small mammals
- Terrestrial arthropods (invertebrates)

The preliminary sampling locations for these parameters are described in Attachment 2 of the OU-2 Alluvial Workplan. These ecological field samples and data will be collected according to SOPs 5.1, Sampling of Periphyton; 5.2, Sampling of Benthic Macroinvertebrates; 5.4, Sampling of Fishes; 5.6, Sampling of Small Mammals; and 5.10, Sampling of Terrestrial Vegetation.

3.5.2 Summary of Analytical Protocols

For the bio-accumulation study, tissue samples from terrestrial and aquatic organisms will be analyzed for the inorganics (metals) and radionuclides listed in Table 2-3 of Attachment 2 to the OU-2 Alluvial Workplan. Metals will be determined by inductively coupled argon plasma spectroscopy (ICP) or graphite furnace absorption spectroscopy (GFFA). The DQOs and detection limits will be developed during the early stages of the EE.

3.6 Equipment Decontamination

Non-dedicated sampling equipment shall be decontaminated between sampling locations in accordance with SOP 1.3, General Equipment Decontamination. Other equipment (e.g., heavy equipment) potentially contaminated during drilling, hydrogeologic/geologic testing, boring, sample collection, etc. shall also be decontaminated as specified in SOP 1.4, Heavy Equipment Decontamination.

3.7 Quality Control Checks

To assure the quality of the field sampling techniques, collection and/or preparation of field quality control (QC) samples are incorporated into the sampling scheme. Field QC samples and collection frequencies for the field investigations are shown in Table 2. A specific sampling schedule will be prepared by the sampling subcontractor for approval by the Laboratory Analysis Task Leaders (Figure 1) prior to sampling.

In addition, a QC sample, which will consist of an extra volume of a designated field sample, shall be collected at a 5 percent frequency for each specific sample matrix. These QC samples shall be collected and submitted to the laboratory to allow for the analysis of laboratory-prepared QC samples to provide the laboratory with a check on its internal operations. The volume required for the QC sample shall be double that of a normal sample.

TABLE 2

FIELD QC SAMPLE COLLECTION FREQUENCY

Activity	Frequency
Field Duplicate	1 in 20[1]
Field Preservation Blanks[2]	1 sample per shipping container (or a minimum of 1 per 20 samples)
Trip Blank[3]	1 in 20
Equipment Rinsate Blank	1 in 20[4], or 1 per day
Drilling and Decontamination Fluids	Sample source and analyze for all analytes of interest prior to use.
Triplicate Samples (benthic samples)	For each sampling site.

1. Or per sampling event, whichever is more frequent.
2. For groundwater samples to be analyzed for inorganics.
3. For groundwater samples to be analyzed for volatile organics only.
4. One equipment rinsate blank in twenty samples, or one per day, whichever is more frequent, for each specific sample matrix being collected when non-dedicated equipment is being used.

Objectives for Field QC Samples

Equipment rinsate blanks are considered acceptable (with no need for data qualification) if the concentration of analytes of interest is less than three times the required detection limit for each analyte as specified in Appendix A. Field duplicate samples should agree within 30 percent relative percent difference for aqueous samples and 40 percent for homogenous, non-aqueous samples. Trip blanks and field preservation blanks (for organics and inorganics, respectively) indicate possible field contamination when analytes are detected above the minimum detection limits presented in Appendix A. The Laboratory Analysis Task Leader (Figure 1) is responsible for verifying these criteria and for checking to see if they are met and for qualifying data.

3.7.2 Laboratory QC

Laboratory QC procedures are used to provide measures of internal consistency of analytical and storage procedures. The laboratory contractor will submit written SOPs to the Laboratory Analysis Task Leader for approval. The laboratory QC procedures that will provide the basis for these SOPs are described in detail in the analytical methods cited in Appendix A. At a minimum, these interlaboratory SOPs shall be consistent with or equivalent to EPA-CLP QC procedures. Laboratory QC techniques for ensuring consistency and validity of analytical results (including detecting potential laboratory contamination of samples) include using reagent blanks, field blanks, internal standard reference materials, laboratory replicates, and field duplicates. The laboratory contractor will follow the standard evaluation guidelines and QC procedures, including frequency of QC checks, that are applicable to the particular type of analytical method being used as specified in the GRRASP and Section 3 of the QAPjP. All results will be forwarded to the Laboratory Analysis Task Leader and validation contractor (Figure 1) for review and verification.

3.8 Data Reduction, Validation, and Reporting

3.8.1 Analytical Reporting Turnaround Times

Analytical reporting turnaround times are as specified in Table 3-1 of the QAPjP.

3.8.2 Data Validation

Validation activities consist of reviewing and verifying field and laboratory data and evaluating the verified data for data quality (i.e., comparison of reduced data to DQOs, where appropriate). The field and laboratory data validation activities and guidelines are described and referenced in Section 3 of the QAPjP. The process for validating the quality of the data is illustrated graphically in Figure 3-1 of the QAPjP, and is also included as part of the sample collection, chain-of-custody, and analysis process illustrated in Figure 8-1 of the QAPjP. The criteria for determining the validity of data are described in Section 3 of the QAPjP.

3.8.3 Data Reduction

The reduction of field and laboratory data is described in Section 3 of the QAPjP. All field and laboratory raw data sets shall be verified (as described above) and shall then be input into the EG&G RFEDS environmental database using a remote data entry module (see SOP 1.14, Database Management).

3.8.4 Data Reporting

Depending on the data validation process, data are flagged as either "valid," "acceptable with qualifications," or "rejected." The results of the data validation shall be reported in EM Department Data Assessment Summary reports. The usability of data (the criteria of which is also described in Section 3 of the QAPjP) shall be addressed by the RI Project Manager (see Figure 1).

4.0 PROCUREMENT DOCUMENT CONTROL

Contractors will perform the field investigations described in the OU-2 Alluvial Workplan. The Contractors will be required to implement all requirements contained in the Workplan, the QAPjP, this QAA, and all applicable SOPs referenced in these documents. Analytical services will also be contracted for analysis of field samples. Appropriate requirements from the QAPjP, this QAA, and the GRRASP shall be passed on to any organizations performing these analyses. Contractors may

also be utilized to validate analytical data packages. Applicable requirements from this QAA shall be transmitted to the validation Contractor.

The implementing Contractors will be required to provide the materials necessary for performing the work described in the OU-2 Alluvial Workplan.

Contractors may be required to submit a QA Program that meets the applicable requirements of the QAPjP and this QAA.

5.0 INSTRUCTIONS, PROCEDURES, AND DRAWINGS

5.1 Workplans

The OU-2 Alluvial Workplan describes the Phase II RFI/RI investigations to be performed. The plan will be reviewed and approved in accordance with the requirements for instructions, procedures, and drawings outlined in the QAPjP.

5.2 Procedures

SOPs approved for use are identified in Table 1, which also indicates their applicability. Any additional quality-affecting procedures proposed for use but not identified here will be developed and approved as required by Section 5 of the QAPjP prior to performing the affected activity.

6.0 DOCUMENT CONTROL

The following documents will be controlled in accordance with the QAPjP:

- Phase II RFI/RI Workplan (Alluvial) for 903 Pad, Mound, and East Trenches Areas (Operable Unit No. 2);
- RFP Site-Wide Quality Assurance Project Plan for CERCLA RI/FS and RCRA RFI/CMS Activities (QAPjP);

- Quality Assurance Addendum to the Rocky Flats Site-Wide QAPjP for Operable Unit No. 2, for 903 Pad, Mound, and East Trenches Areas (Alluvial) Phase II RFI/RI Activities;
- EMAD Operating Procedures (or SOPs) specified in Table 1 of this QAA.

7.0 CONTROL OF PURCHASED ITEMS AND SERVICES

Contractors that provide services to support the OU-2 Alluvial Workplan activities will be selected and evaluated as outlined in the QAPjP. This includes preaward evaluation/audit of proposed Contractors as well as periodic audit of the acceptability of Contractor performance during the life of the contract. Such audits shall be performed at least annually or once during the life of the project, whichever is more frequent. Also see Section 18.0 of the QAPjP.

8.0 IDENTIFICATION AND CONTROL OF ITEMS, SAMPLES, AND DATA

8.1 *Sample Containers/Preservation*

Appropriate volumes, containers, preservation requirements, and holding times for all ER Program soil and water matrix samples are presented in Tables 8-1 through 8-4 of the QAPjP. Requirements for environmental evaluation samples are included in Table 3.

8.2 Sample Identification

Samples shall be labeled and identified in accordance with Section 8.3.2.2 of the QAPjP and the SOPs in Table 1. Samples will have unique identification that traces the sample to the source(s) and indicates the media type (e.g., GW for groundwater samples), the sequential number for the sample, the sampling contractors alpha identification, and the date. Label will also include the method of sampling and the conditions prevailing at the time of sampling.

TABLE 3

HOLDING TIMES, PRESERVATION METHODS, AND SAMPLE CONTAINERS FOR BIOTA SAMPLES

	Holding Time From Date Collected	Preservation Method	Container	Approximate Sample Size*
SAMPLES FOR METALS ANALYSES				
TERRESTRIAL VEGETATION				
- Metals Determined by ICP**	6 mos.	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	25 g
- Metals Determined by GFAA***	6 mos.	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	25 g
- Hexavalent Chromium	24 hours	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	25 g
- Mercury	28 days	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	5 g
Periphyton and Benthic Macroinvertebrates				
- Metals Determined by ICP	6 mos.	Freeze & ship w/dry ice	Plastic	25 g
- Metals Determined by GFAA	6 mos	Freeze & ship w/dry ice	Plastic	25 g
- Hexavalent Chromium	24 hours	Freeze & ship w/dry ice	Plastic	25 g
- Mercury	28 days	Freeze & ship w/dry ice	Plastic	5 g

TABLE 3

HOLDING TIMES, PRESERVATION METHODS, AND SAMPLE CONTAINERS FOR BIOTA SAMPLES

	Holding Time From Date Collected	Preservation Method	Container	Approximate Sample Size*
SAMPLES FOR RADIONUCLIDE ANALYSES				
Terrestrial Vegetation				
- Uranium 223, 234, 235, 238 Americium 241 Plutonium 239, 240	6 mos	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	1 kg
Periphyton and Benthic Macroinvertebrates				
- Uranium 233, 234, 245, 238 Americium 241 Plutonium 239, 240	6 mos	Freeze & ship w/dry ice	Plastic	1 kg

* Sample size may vary with specific laboratory requirements.

**ICP = Inductively Coupled Argon Plasma Emission Spectroscopy. Metals to be determined include Ba, Cr, Cu, and Fe.

***GFAA = Graphite Furnace Atomic Absorption Spectroscopy. Metals to be determined include As, Cd, Li, Pg, Se, and Sr.

8.3 Chain-of-Custody

Sample chain-of-custody will be maintained through the application of SOP 1.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples, and as illustrated in Figure 8-1 of the QAPjP for all environmental samples collected during field investigations.

9.0 CONTROL OF PROCESSES

The overall process of collecting samples, performing analysis, and inputting the data into a database is considered a process that requires control. The process is controlled through a series of written procedures that govern and document the work activities. The process is illustrated diagrammatically in Section 8 of the QAPjP.

10.0 INSPECTION

Procured materials and construction activities (e.g., groundwater monitoring well installation) shall be inspected (as applicable) in accordance with the requirements specified in Section 10.0 of the QAPjP and the installation specifications included in the OU-2 Alluvial Workplan and field sampling SOPs.

11.0 TEST CONTROL

Test control requirements for the hydraulic testing program (multi-well pumping and tracer tests) will be controlled according to the requirements and specifications described in Section 5.5.1 of the OU-2 Alluvial Workplan.

12.0 CONTROL OF MEASURING AND TEST EQUIPMENT (M&TE)

12.1 Field Equipment

Specific conductivity, temperature, and pH of groundwater samples shall be measured in the field. Field measurements will be taken and the instruments calibrated as specified in SOP 2.5 (see Table 1). Measurements shall be made using the following equipment (or EG&G-approved alternates):

- Specific Conductivity: HACH Conductivity Meter
- pH: HACH pH Meter (this meter will also be used for temperature measurements)
- Temperature: HACH pH Meter

Each piece of field equipment shall have a file that contains:

- Operating instructions;
- Routine preventative maintenance procedures, including a list of critical spare parts to be provided or available in the field;
- Calibration methods, frequency, and description of the calibration solutions; and
- Standardization procedures (traceability to nationally recognized standards).

The above information shall, in general, conform to the manufacturer's recommended operating instructions or shall explain the deviation from said instructions.

12.2 Laboratory Equipment

Laboratory analyses will be performed by contracted laboratories. The equipment used to analyze environmental samples shall be calibrated, maintained, and controlled in accordance with the requirements contained in the specific analytical methods used and the manufacturer's instructions. Laboratories are required to submit calibration procedures to EG&G for review and approval. Initial and continuing calibration data for analytical equipment used will be included in the data packages submitted to EG&G by the laboratories.

13.0 HANDLING, STORAGE, AND SHIPPING

Samples shall be packaged, transported, and stored in accordance with SOP 1.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples. Maximum sample holding times, sample preservative, sample volumes, and sample containers are specified in Table 8-1 of the QAPjP.

EG&G will develop and implement an EM Department administrative procedure for receiving, handling, and storing construction materials (e.g., well casing) to ensure only appropriate, accepted materials are used and are handled and stored to prevent contamination or damage prior to use/installation.

14.0 STATUS OF INSPECTION, TEST, AND OPERATIONS

The requirements for the identification of inspection, test, and operating status of items, products, systems, or equipment shall be implemented as specified in Section 14.0 of the QAPjP. A log specifying the status of all boreholes and groundwater monitoring wells shall be maintained by the Field Activities Task Leader, which will include: well/borehole identification number, ground elevation, casing depth of hole, depth to alluvial, static water level (as applicable), depth to top and bottom of screen (as applicable), diameter of hole, diameter of casing, and top/bottom of casing.

The status of monitoring/test equipment will be maintained in a log directly traceable to the particular piece of equipment, and status indicator tags shall be attached to equipment where such a tag will not interfere with equipment operation.

15.0 CONTROL OF NONCONFORMANCES

The requirements for the identification, control, evaluation, and disposition of nonconforming items, samples, and data will be implemented as specified in Section 15.0 of the QAPjP. Nonconformances identified by the implementing contractor shall be submitted to the ER Department QA Program Manager (QAPM) for processing as outlined in the QAPjP.

16.0 CORRECTIVE ACTION

The requirements for the identification, documentation, and verification of corrective actions for conditions adverse to quality will be implemented as outlined in Section 16.0 of the QAPjP. Conditions adverse to quality identified by the implementing Contractor shall be documented and submitted to the EM Department QAPM for processing as outlined in the QAPjP.

17.0 QUALITY ASSURANCE RECORDS

All field records, including field data records, scientific notebooks, drilling logs, etc., are considered QA records and shall be controlled in accordance with the SOP 1.2, Field Document Control. QA records to be generated during OU-2 Alluvial Workplan activities include, but are not limited to:

- Field Logs (e.g., sample collection notebooks/logs for water, sediment, and air)
- Calibration Records
- Sample Collection and Chain-of-Custody Records
- Drilling Logs
- Work Plan/Field Sampling Plan
- QAPjP/QAA
- Audit/Surveillance/Inspection Reports
- Nonconformance Reports
- Corrective Action Documentation
- Data Validation Results
- Analytical Results
- Procurement/Contracting Documentation
- Training/Qualification Records
- Inspection Records

All QA records generated during the planning, implementation, and closure of the Phase II RFI/RI activities for OU-2 will be submitted to the EM Department Custodian for processing according to the EM Department QA records system described in Section 17.3 of the QAPjP.

18.0 QUALITY VERIFICATION

The requirements for the verification of quality shall be implemented as specified in Section 18.0 of the QAPjP. EG&G will conduct audits of the laboratory contractor as specified in the GRRASP (a minimum of two audits during sample analysis for OU-2 Alluvium Samples). The QAPM shall develop a surveillance schedule with the surveillance intervals based on the importance and complexity of each activity sub-task. Intervals will also be based on the schedule contained in Section 7.0 of the OU-2 Alluvial Workplan.

Specific tasks that will be monitored by the surveillance program are as follows:

- Borings and well installations (approximately 10 percent of the holes)
- Field Sampling (approximately 5 percent of each type of sample collected)
- Records Management (a surveillance will be conducted once at the initiation of OU-2 Phase II activities, and monthly thereafter)
- Data Verification, validation, and reporting

Audits of Contractors providing field investigation, construction, and analytical support services shall be performed at least annually or once during the life of the project, whichever is more frequent.

19.0 SOFTWARE CONTROL

The requirements for software development and control shall be implemented as specified in Section 19.0 of the QAPjP. Computer software utilized by Contractors will be furnished by EG&G. Only database and spreadsheet software will be used for the OU-2 Alluvial Workplan activities. The procedure applicable to the use of the database that stores environmental data in the field is SOP 1.14, Field Data Management.

APPENDIX A

Analytical Methods, Detection Limits, and Data Quality Objectives

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	BOREHOLE	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
INDICATORS									
Total Suspended Solids	EPA 160.2[d]	X[U]				10 mg/L	NA	20%RPD[f]	80-120% LCS Recovery
Total Dissolved Solids	EPA 160.1[d]	X[F]	X[F]			5 mg/L	NA	20%RPD[f]	80-120% LCS Recovery
pH	EPA 150.1[d]	X[U]	X[F]			0.1 pH units	0.1 pH units	NA	±0.05 pH units
INORGANICS									
Target Analyte List - Metals		X[F]	X[F]	X	X			WATER/SOIL	WATER/SOIL
Aluminum	EPA CLP SOW[e]					200 ug/L[4]	40 mg/Kg[4]	**	***
Antimony	EPA CLP SOW[e]					60	12		
Arsenic (GFAA)	EPA CLP SOW[e]					10	2		
Barium	EPA CLP SOW[e]					200	40		
Beryllium	EPA CLP SOW[e]					5	1.0		
Cadmium	EPA CLP SOW[e]					5	1.0		
Calcium	EPA CLP SOW[e]					5000	2000		
Chromium	EPA CLP SOW[e]					10	2.0		
Cobalt	EPA CLP SOW[e]					50	10		
Copper	EPA CLP SOW[e]					25	5.0		
Cyanide	*EPA 335.3 (modified for CLP)*[e,d]					5	10		
Iron	EPA CLP SOW[e]					100 ug/L[4]	20 mg/Kg[4]	**	***
Lead (GFAA)	EPA CLP SOW[e]					3	1.0		
Magnesium	EPA CLP SOW[e]					5000	2000		
Manganese	EPA CLP SOW[e]					15	3.0		
Mercury (CVAA)	EPA CLP SOW[e]					0.2	0.2		
Nickel	EPA CLP SOW[e]					40	8.0		
Potassium	EPA CLP SOW[e]					5000	2000		
Selenium (GFAA)	EPA CLP SOW[e]					5	1.0		
Silver	EPA CLP SOW[e]					10	2.0		
Sodium	EPA CLP SOW[e]					5000	2000		
Thallium (GFAA)	EPA CLP SOW[e]					10	2.0		
Vanadium	EPA CLP SOW[e]					50	10		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Zinc	EPA CLP SOW[a]	20	4.0

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	BOREHOLE	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
Other Metals		X[U]	X[F]	X	X			WATER/SOIL	WATER/SOIL
Molybdenum	EPA CLP SOW[b] (ICAP)					8 ug/L[4]	40 mg/Kg[4]	**	***
Cesium	EPA CLP SOW[b]					1000	200		
Strontium	EPA CLP SOW[b]					200	40		
Lithium	EPA CLP SOW[b]					100	20		
Tin	EPA CLP SOW[b]					200	40		
Other Inorganics									
Percent Solids	EPA 160.3[d]			X	X	NA	10 mg	NA	NA
Sulfide	EPA 376.1[d]			X	X	NA	4 ug/g	Same as metals	Same as metals
ANIONS								Water/Soil	Water/Soil
Carbonate	EPA 310.1[d]	X[U]	X[U]			10 mg/L	NA	Same as metals	Same as metals
Bicarbonate	EPA 310.1[d]	X[U]	X[U]			10 mg/L	NA		
Chloride	EPA 325.2[d]	X[U]	X[U]			5 mg/L	NA		
Sulfate	EPA 375.4[d]	X[U]	X[U]			5 mg/L	NA		
Nitrate as N	EPA 353.2[d] or 353.3[d]	X[U]	X[U]			1 mg/L	NA		
Fluoride	EPA 340.2[d]	X[U]	X[U]			5 mg/L	NA		
Oil and Grease	EPA 413.2[d]	X[U]				5 mg/L	NA	**	***
*Total Petroleum Hydrocarbons	EPA 418.1[d]			X	X	NA	10 mg/Kg	NA/40	NA/80-120
Target Compound List - Volatiles	EPA CLP SOW[c]	X[U]	X[U]	X	X			WATER/SOIL	WATER/SOIL
Chloromethane	EPA CLP SOW[c]					10 ug/L	10 ug/Kg (low)[3]	**	***
Bromomethane	EPA CLP SOW[c]					10	10		
Vinyl Chloride	EPA CLP SOW[c]					10	10		
Chloroethane	EPA CLP SOW[c]					10	10		
Methylene Chloride	EPA CLP SOW[c]					5	5		
Acetone	EPA CLP SOW[c]					10	10		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	BOREHOLE	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
Carbon Disulfide	EPA CLP SOW[c]					5	5		
1,1-Dichloroethene	EPA CLP SOW[c]					5	5		
1,1-Dichororethane	EPA CLP SOW[c]					5 ug/L	5 ug/Kg(low)[3]	**	***
Target Compound List - Volatiles (continued)		X[u]	X[u]	X	X			WATER/SOIL	WATER/SOIL
total 1,2-Dichloroethene	EPA CLP SOW[c]					5	5		
Chloroform	EPA CLP SOW[c]					5	5		
1,2-Dichloroethane	EPA CLP SOW[c]					1	5		
2-Butanone	EPA CLP SOW[c]					10	10		
1,1,1-Trichoroethane	EPA CLP SOW[c]					5	5		
Carbon Tetrachloride	EPA CLP SOW[c]					5	5		
Vinyl Acetate	EPA CLP SOW[c]					10	10		
Bromodichloromethane	EPA CLP SOW[c]					5	5		
1,2-Dichloropropane	EPA CLP SOW[c]					5	5		
cis-1,3-Dichloropropene	EPA CLP SOW[c]					5	5		
Trichloroethene	EPA CLP SOW[c]					5	5		
Dibromochloromethane	EPA CLP SOW[c]					5	5		
1,1,2-Trichloroethane	EPA CLP SOW[c]					5	5		
Benzene	EPA CLP SOW[c]					5	5		
trans-1,2-Dichloropropene	EPA CLP SOW[c]					5	5		
Bromoform	EPA CLP SOW[c]					5	5		
4-Methyl-2-pentanone	EPA CLP SOW[c]					10	10		
2-Hexanone	EPA CLP SOW[c]					10	10		
Tetrachloroethene	EPA CLP SOW[c]					5	5		
Toluene	EPA CLP SOW[c]					5	5		
1,1,2,2-Tetrachoroethane	EPA CLP SOW[c]					5	5		
Chlorobenzene	EPA CLP SOW[c]					5	5		
Ethyl Benzene	EPA CLP SOW[c]					5	5		
Styrene	EPA CLP SOW[c]					5	5		
Total Xylenes	EPA CLP SOW[c]					5	5		
Target Compound List - Semi-Volatiles			X[u]	X	X			WATER/SOIL	WATER/SOIL
Phenol	EPA CLP SOW[c]					10 ug/L	330 ug/Kg[3]	**	***
bis(2-Chloroethyl)ether	EPA CLP SOW[c]					10	330		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	BOREHOLE	SED	Required Detection Limits Water	Soil/Sed.	Precision Objective	Accuracy Objective
2-Chlorophenol	EPA CLP SOW[c]					10	330		
1,3-Dichlorobenzene	EPA CLP SOW[c]					10	330		
1,4-Dichlorobenzene	EPA CLP SOW[c]					10	330		
Benzyl Alcohol	EPA CLP SOW[c]					10	330		
1,2-Dichlorobenzene	EPA CLP SOW[c]					10	330		
2-Methylphenol	EPA CLP SOW[c]					10	330		
bis(2-Chloroisopropyl)ether	EPA CLP SOW[c]					10	330		
Target Compound List - Semi-Volatiles (continued)			X[u]	X	X			WATER/SOIL	WATER/SOIL
4-Methylphenol	EPA CLP SOW[c]					10	330		
N-Nitroso-Dipropylamine	EPA CLP SOW[c]					10	330		
Hexachloroethane	EPA CLP SOW[c]					10	330		
Nitrobenzene	EPA CLP SOW[c]					10	330		
Isophorone	EPA CLP SOW[c]					10	330		
2-Nitrophenol	EPA CLP SOW[c]					10	330		
2,4-Dimethylphenol	EPA CLP SOW[c]					10	330		
Benzoic Acid	EPA CLP SOW[c]					50	1600		
bis(2-Choroethoxy)methane	EPA CLP SOW[c]					10	330		
2,4-Dichlorophenol	EPA CLP SOW[c]					10	330		
1,2,4-Trichlorobenzene	EPA CLP SOW[c]					10	330		
Naphthalene	EPA CLP SOW[c]					10	330		
4-Chloroanaline	EPA CLP SOW[c]					10	330		
Hexachlorobutadiene	EPA CLP SOW[c]					10	330		
4-Chloro-3-methylphenol	EPA CLP SOW[c]					10	330		
2-Methylnaphthalene	EPA CLP SOW[c]					10	330		
Hexachlorocyclopentadiene	EPA CLP SOW[c]					10 ug/L	330 ug/Kg[3]	**	***
2,4,6-Trichlorophenol	EPA CLP SOW[c]					10	330		
2,4,5-Trichlorophenol	EPA CLP SOW[c]					50	1600		
2-Chloronaphthalene	EPA CLP SOW[c]					10	330		
2-Nitroanaline	EPA CLP SOW[c]					50	1600		
Dimethylphthalate	EPA CLP SOW[c]					10	330		
Acenaphthylene	EPA CLP SOW[c]					10	330		
2,6-Dinitrotoluene	EPA CLP SOW[c]					10	330		
3-Nitroaniline	EPA CLP SOW[c]					50	1600		
Acenaphthene	EPA CLP SOW[c]					10	330		
2,4-Dinitrophenol	EPA CLP SOW[c]					50	1600		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

4-Nitrophenol	EPA CLP SOW[c]					50	1600		
Dibenzofuran	EPA CLP SOW[c]					10	330		
2,4-Dinitrotoluene	EPA CLP SOW[c]					10	330		
Diethylphthalate	EPA CLP SOW[c]					10	330		
4-Chlorophenol Phenyl ether	EPA CLP SOW[c]					10	330		
Fluorene	EPA CLP SOW[c]					10	330		
4-Nitroanaline	EPA CLP SOW[c]					50	1600		
4,6-Dinitro-2-methylphenol	EPA CLP SOW[c]					50	1600		
N-nitrosodiphenylamine	EPA CLP SOW[c]					10	330		
4-Bromophenyl Phenyl ether	EPA CLP SOW[c]					10	330		
Hexachlorobenzene	EPA CLP SOW[c]					10	330		
Analyte	**Method**	**SW**	**GW**	**BOREHOLE**	**SED**	**Required Detection Limits Water**	**Soil/Sed.**	**Precision Objective**	**Accuracy Objective**
Target Compound List - Semi-Volatiles (continued)			X[U]	X	X			WATER/SOIL	WATER/SOIL
Pentachlorophenol	EPA CLP SOW[c]					50	1600		
Phenanthrene	EPA CLP SOW[c]					10	330		
Anthracene	EPA CLP SOW[c]					10 ug/L	330 ug/Kg[3]	**	***
Di-n-butylphthalate	EPA CLP SOW[c]					10	330		
Fluoranthene	EPA CLP SOW[c]					10	330		
Pyrene	EPA CLP SOW[c]					10	330		
Butyl Benzylphthalate	EPA CLP SOW[c]					10	330		
3,3'-Dichlorobenzidine	EPA CLP SOW[c]					20	660		
Benzo(a)anthracene	EPA CLP SOW[c]					10	330		
Chrysene	EPA CLP SOW[c]					10	330		
bis(2-ethylhexyl)phthalate	EPA CLP SOW[c]					10	330		
Di-n-octyl Phthalate	EPA CLP SOW[c]					10	330		
Benzo(b)fluoranthene	EPA CLP SOW[c]					10	330		
Benzo(k)fluoranthene	EPA CLP SOW[c]					10	330		
Benzo(a)pyrene	EPA CLP SOW[c]					10	330		
Indeno(1,2,3-cd)pyrene	EPA CLP SOW[c]					10	330		
Dibenz(a,h)anthracene	EPA CLP SOW[c]					10	330		
Benzo(g,h,i)perylene	EPA CLP SOW[c]					10	330		
Target Compound List - Pesticides/PCBs			X[U]	X	X			WATER/SOIL (%RPD)	WATER/SOIL (% Recovery)
alpha-BHC	EPA CLP SOW[c]					0.05 ug/L	8.0 ug/Kg[3]	**	***

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Analyte	Method	SW	GW	BOREHOLE	SED	Required Detection Limits Water	Required Detection Limits Soil/Sed.	Precision Objective	Accuracy Objective
beta-BHC	EPA CLP SOW[c]					0.05	8.0		
delta-BHC	EPA CLP SOW[c]					0.05	8.0		
gamma-BHC (Lindane)	EPA CLP SOW[c]					0.05	8.0		
Heptachlor	EPA CLP SOW[c]					0.05	8.0		
Aldrin	EPA CLP SOW[c]					0.05 ug/L	8.0 ug/Kg[3]	**	***
Heptachlor Epoxide	EPA CLP SOW[c]					0.05	8.0		
Endosulfan I	EPA CLP SOW[c]					0.05	8.0		
Dieldrin	EPA CLP SOW[c]					0.10	16.0		
4,4'-DDE	EPA CLP SOW[c]					0.10	16.0		
Endrin	EPA CLP SOW[c]					0.10	16.0		
Endosulfan II	EPA CLP SOW[c]					0.10	16.0		
4,4'-DDD	EPA CLP SOW[c]					0.10	16.0		
Endosulfan Sulfate	EPA CLP SOW[c]					0.10	16.0		
4,4'-DDT	EPA CLP SOW[c]					0.10	16.0		
Methoxychlor	EPA CLP SOW[c]					0.5	80.0		
Target Compound List - Pesticides/PCBs (continued)			X[U]	X	X			WATER/SOIL (%RPD)	WATER/SOIL (% Recovery)
Endrin Ketone	EPA CLP SOW[c]					0.10	16.0		
alpha-Chlordane	EPA CLP SOW[c]					0.5	80.0		
gamma-Chlordane	EPA CLP SOW[c]					0.5	80.0		
Toxaphene	EPA CLP SOW[c]					1.0	160.0		
AROCLOR-1016	EPA CLP SOW[c]					0.5	80.0		
AROCLOR-1221	EPA CLP SOW[c]					0.5	80.0		
AROCLOR-1232	EPA CLP SOW[c]					0.5	80.0		
AROCLOR-1242	EPA CLP SOW[c]					0.5	80.0		
AROCLOR-1248	EPA CLP SOW[c]					0.5	80.0		
AROCLOR-1254	EPA CLP SOW[c]					1.0	160.0		
AROCLOR-1260	EPA CLP SOW[c]					1.0	160.0		
RADIONUCLIDES								(Replicate Analyses)	(Laboratory Control Sample)
Gross Alpha	s,f,g,h,i,k,l,m,n	X[F,U]	X[F]	X	X	2 pCi/L	4 pCi/g	**	***
Gross Beta	s,f,g,h,i,k,l,m,n	X[F,U]	X[F]	X	X	4 pCi/L	10 pCi/g		
Uranium 233+234	f,h,i,m,n,s,l	X[F,U]	X[F]	X	X	0.6 pCi/L	0.3 pCi/g		

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

Uranium 235,238	f,h,i,m,n,s,l	$X^{F,U}$	X^{F}	X	X	0.6 pCi/L	0.3 pCi/g
Americium 241	p,q,s,l,i	$X^{F,U}$	X^{F}	X	X	0.01 pCi/L	0.02 pCi/g
Plutonium 239+240	o,p,s,l,i	$X^{F,U}$	X^{F}	X	X	0.01 pCi/L	0.03 pCi/g
Tritium	f,g,h,m,s,i,l	X^{U}	X^{U}	X	X	400 pCi/L	400 pCi/L
Strontium 89,90	f,h,i,m,s,l			X	X	NA	1 pCi/g
Strontium 90 only	f,h,i,m,s,l	$X^{F,U}$	X^{F}			1 pCi/L	NA
Cesium 137	m,h,l,i	$X^{F,U}$	X^{F}	X	X	1 pCi/L	0.1 pCi/g
Radium 226	f,g,h,m[5],i,s,l	$X^{F,U}$	X^{F}			0.5 pCi/L	0.5 pCi/g
Radium 228	f,g,h,m[5],i,s,l	$X^{F,U}$	X^{F}			1 pCi/L	0.5 pCi/g

SURFICIAL SOIL SAMPLING PARAMETERS

Total Organic Carbon	ALPHA 5310[1]	1 mg/kg	**	***
Carbonate	EPA 310.1[4]	2 mg/kg		
pH	EPA 150.1[4]	0.1 pH units		
Specific Conductance	EPA 120.1[1]	2.5 umho/cm		
Plutonium 239+240	i,l,o,p,s	0.03 pCi/g		
Americium 241	i,l,p,q,s	0.01 pCi/g		
Uranium 233,234,235,238	f,h,i,l,m,n,s	0.06 pCi/g		

Analyte	Method	SW	GW	BOREHOLE	SED	Readability Objective	Accuracy
FIELD PARAMETERS							
pH	1	X	X			± 0.1 pH unit	± 0.2 pH units
Specific Conductance	1	X	X			2.5 umho/cm[7] 25 umho/cm[8] 250 umho/cm[9]	± 2.5% max. error at 500, 5000, 50000 umhos/cm plus probe; ± 3.0% max error at 250, 2500, and 25000 plus probe accuracy of ± 2.0%.
Temperature	1	X	X			± 0.1°C	± 1.0°C
Dissolved Oxygen	1	X				± 0.1 mg/L	± 10%

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

* For samples collected from IHSSs 102 and 105 only [BH01,BH02,BH03,BH04,BH05,BH06,BH07,BH08 (MW33),BH09,BH15,BH16,BH17,BH18,MW01,MW02,MW03,MW33 (BH08)].
** Precision objective = control limits specified in referenced method and/or Data Validation Guidelines.
*** Accuracy objective = control limits specified in referenced method (in GRRASP for radionuclides).
F = Filtered
U = Unfiltered

1. Measured in the field in accordance with instrument manufacturer's instructions. The instruments to be used are specified in Section 12.
2. Medium soil/sediment required detection limits for pesticide/PCB TCL compounds are 15 times the individual low soil/sediment required detection limit.
3. Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.
4. Higher detection limits may only be used in the following circumstance: If the sample concentration exceeds five times the detection limit of the instrument or method in use, the value may be reported even though the instrument or method detection limit may not equal the required detection limit. This is illustrated in the example below:

   For lead:

   Method in use - ICP
   Instrument Detection Limit (IDL) - 40
   Sample Concentration - 220
   Required Detection Limit (RDL) - 3

   The value of 220 may be reported even though the instrument detection limit is greater than the RDL.

   Note: The specified detection limits are based on a pure water matrix. The detection limits for samples may be considerably higher depending on the sample matrix.
5. If gross alpha > 5 pCi/L, analyze for Radium 226; if Radium 226 > 3 pCi/L, analyze for Radium 228.
6. The detection limits presented were calculated using the formula in N.R.C. Regulatory Guide 4.14, Appendix Lower Limit of Detection, pg. 21, and follow:

$$LLD = \frac{4.66\ (BKG/BKG\ DUR)^{1/2}}{(2.22)(Eff)(CR)(SR)(e^{-\lambda t})(Aliq)}$$

Where:
LLD = Lower Limit of Detection in pCi per sample unit.
BKG = Instrument Background in counts per minute (CPM).
Eff = Counting efficiency in cpm/disintegration per minute (dpm).
CR = Fractional radiochemical yield.
SR = Fractional radiochemical yield of a known solution.
λ = The radioactive decay constant for the particular radionuclide.
t = The elapsed time between sample collection and counting.
Aliq = Sample volume.
BKG DUR = Background count duration in minutes.

$$MDA = \frac{4.66\ (BKG/Sample\ DUR)^{1/2}}{(2.22)(Eff)(CR)(SR)e^{-\lambda t}(Aliq)}$$

MDA = Minimum Detectable Activity in pCi per sample unit
BKG = same as for LLD
Eff = same as for LLD
CR = same as for LLD
SR = same as for LLD
λ = same as for LLD
t = same as for LLD
Aliq = same as for LLD
Sample DUR = sample count duration in minutes

ANALYTICAL METHODS, DETECTION LIMITS, AND DATA QUALITY OBJECTIVES

7. On 500 umho/cm range.
8. On 5000 umho/cm range.
9. On 50000 umho/cm range.

a. U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration, 7/88 (or latest version).

b. U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration, 7/88 (or latest version). The specific method to be utilized is at the laboratory's discretion provided it meets the specified detection limit.

c. U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, 2/88 (or latest version).

d. Methods are from "Methods for Chemical Analysis of Water and Wastes," U.S. Environmental Protection Agency, 1983, unless otherwise indicated.

e. Methods are from "Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods," (SW-846, 3rd Ed.), U.S. Environmental Protection Agency.

f. U.S. Environmental Protection Agency, 1979, Radiochemical Analytical Procedures for Analysis of Environmental Samples, Report No. EMSL-LY-0539-1, Las Vegas, NV, U.S. Environmental Protection Agency.

g. American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1985. Standard Methods for the Examination of Water and Wastewater, 16th ed., Washington, D.C., Am. Public Health Association.

h. U.S. Environmental Protection Agency, 1976. Interim Radiochemical Methodology for Drinking Water, Report No. EPA-600/4-75-008. Cincinnati U.S. Environmental Protection Agency.

i. Harley, J.H., ed., 1975, ASL Procedures Manual, HASL-300; Washington, D.C., U.S. Energy Research and Development Administration.

j. U.S. EPA, 1982. "Methods for Organic Analysis of Municipal and Industrial Waste Water," US EPA-600/4-82-057.

k. "Handbook of Analytical Procedures," USAEC, Grand Junction Lab. 1970, page 196.

l. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," EPA-600/4-80-032, August 1980, Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268.

m. "Methods for Determination of Radioactive Substances in Water and Fluvial Sediments," U.S.G.S. Book 5, Chapter A5, 1977.

n. "Acid Dissolution Method for the Analysis of Plutonium in Soil," EPA-600/7-79-081, March 1979, U.S. EPA Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, 1979.

o. "Procedures for the Isolation of Alpha Spectrometrically Pure Plutonium, Uranium, and Americium," by E.H. Essington and B.J. Drennon, Los Alamos National Laboratory, a private communication.

p. "Isolation of Americium from Urine Samples," Rocky Flats Plant, Health, Safety, and Environmental Laboratories.

q. "Radioactivity in Drinking Water," EPA 570/9-81-002.

r. If the sample or duplicate result is <5 x IDL, then the control limit is ± IDL.

s. U.S. EPA, 1987. "Eastern Environmental Radiation Facility Radiochemistry Procedures Manual," EPA-520/5-84-006.